O I P E JC41
JUL 1 9 2004
PATENT & TRADEMARK OFFICE

07-20-04

AF/2828
IFW

TRANSMITTAL OF APPEAL BRIEF	Docket No. 60988/P001US/10103485

In re Application of: Jason N. Farmer et al.

Application No.	Filing Date	Examiner	Group Art Unit
09/945,381-Conf. #2127	August 31, 2001	J. A. Menefee	2828

Invention: SPECTRALLY TAILORED RAMAN PUMP LASER

TO THE COMMISSIONER OF PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed: May 19, 2004 .

The fee for filing this Appeal Brief is 165.00 .

☐ Large Entity ☒ Small Entity

☒ A check in the amount of 165.00 is enclosed.

☐ Charge the amount of the fee to Deposit Account No. ________ .
This sheet is submitted in duplicate.

☐ Payment by credit card. Form PTO-2038 is attached.

☒ The Director is hereby authorized to charge any additional fees that may be required or credit any overpayment to Deposit Account No. 06-2380 .
This sheet is submitted in duplicate.

Christopher S. L. Crawford
Dated: July 19, 2004

Christopher S. L. Crawford
Attorney Reg. No. : 51,586
FULBRIGHT & JAWORSKI L.L.P.
2200 Ross Avenue, Suite 2800
Dallas, Texas 75201-2784
(214) 855-8378

Appeal Brief Transmittal

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as Express Mail, Airbill No. EV482735130US, in an envelope addressed to: MS Appeal Brief - Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below.

Dated: July 19, 2004 Signature: Laura Horton (Laura Horton)

PTO/SB/17 (10-03)
Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

[X] Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 165.00

Complete if Known	
Application Number	09/945,381-Conf. #2127
Filing Date	August 31, 2001
First Named Inventor	Jason N. Farmer
Examiner Name	J. A. Menefee
Art Unit	2828
Attorney Docket No.	60988/P001US/10103485

METHOD OF PAYMENT *(check all that apply)*

[X] Check [ ] Credit Card [ ] Money Order [ ] Other [ ] None

[ ] Deposit Account:

Deposit Account Number: 06-2380

Deposit Account Name: Fulbright & Jaworski L.L.P.

The Director is authorized to: *(check all that apply)*

[ ] Charge fee(s) indicated below [X] Credit any overpayments

[X] Charge any additional fee(s) or any underpayment of fee(s)

[ ] Charge fee(s) indicated below, **except for the filing fee**

to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($) 0.00

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		-** =		x		=	
Independent Claims		-** =		x		=	
Multiple Dependent						=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0.00

***or number previously paid, if greater; For Reissues, see above*

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge – late filing fee or oath	
1052	50	2052	25	Surcharge – late provisional filing fee or cover sheet.	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	165.00
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive – unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) ____

*Reduced by Basic Filing Fee Paid **SUBTOTAL (3)** ($) 165.00

SUBMITTED BY				(Complete *(if applicable)*)	
Name (Print/Type)	Christopher S. L. Crawford	*Registration No. (Attorney/Agent)*	51,586	*Telephone*	(214) 855-8378
Signature	Christopher S. L. Crawford			*Date*	July 19, 2004

Fee Transmittal

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as Express Mail, Airbill No. EV482735130US, in an envelope addressed to: MS Appeal Brief - Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below.

Dated: July 19, 2004 Signature: Laura Horton (Laura Horton)

25434632.1

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as Express Mail, Airbill No.EV482735130US, in an envelope addressed to: MS Appeal Brief - Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below.

Dated: July 19, 2004 Signature: Laura Horton (Laura Horton)

Docket No.: 60988/P001US/10103485
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Jason N. Farmer et al.

Application No.: 09/945,381 Confirmation No.: 2127

Filed: August 31, 2001 Art Unit: 2828

For: SPECTRALLY TAILORED RAMAN PUMP LASER Examiner: J. A. Menefee

APPELLANT'S BRIEF

MS Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This brief is in furtherance of the Notice of Appeal, filed in this case on May 19, 2004.

The fees required under § 1.17(f) and any required petition for extension of time for filing this brief and fees therefor, are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief is transmitted in triplicate.

This brief contains items under the following headings as required by 37 C.F.R. § 1.192 and M.P.E.P. § 1206:

I. Real Party In Interest
II Related Appeals and Interferences
III. Status of Claims
IV. Status of Amendments
V. Summary of Invention
VI. Issues
VII. Grouping of Claims
VIII. Arguments

07/21/2004 SZEWDIE1 00000040 09945381
01 FC:2402 165.00 OP

I. REAL PARTY IN INTEREST

The real party in interest for this appeal is:

nLight Photonics Corporation of Vancouver, WA.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

A. Total Number of Claims in Application

There are 20 claims pending in application.

B. Current Status of Claims

1. Claims canceled: 1-36
2. Claims withdrawn from consideration but not canceled: None
3. Claims pending: 37-56
4. Claims allowed: None
5. Claims rejected: 37-56

C. Claims On Appeal

The claims on appeal are claims 37-56.

IV. STATUS OF AMENDMENTS

An amendment was not filed after the final office action issued November 21, 2003. Accordingly, the claims under appeal are the claims presented in the amendment, dated September 29, 2003.

V. SUMMARY OF INVENTION

The present invention is related to generating Raman gain. Raman gain refers to optical amplification that relies on stimulated Raman scattering (SRS) as the physical mechanism giving rise to the amplification. Specifically, Raman scattering is a process in which light is frequency downshifted from a nonlinear interaction between the light and the material (e.g., an optical fiber). When photons of two different wavelengths are present in an optical fiber, Raman scattering can be stimulated. In the SRS process, longer wavelength photons stimulate shorter wavelength photons to experience a Raman scattering effect. The shorter wavelengths are destroyed and longer wavelength photons identical to the longer wavelength photons are created. *See* paragraph **[0003]** of the application.

The SRS process may be modeled using a coupled set of differential equations. *See* paragraph **[0004]** of the application. Because of the non-linearity of the SRS process as modeled by the coupled set of differential equations, it is difficult to obtain flat Raman gain. Flat Raman gain refers to the lack of variation in gain experienced by optical channels across an amplification band. *See* paragraph **[0006]** of the application.

In the present application, flat Raman gain is achieved by adapting an incoherently beam combined (IBC) laser (see laser 40 of FIGURE 4, emitter device 60 of FIGURE 6, and laser 70 of FIGURE 7) to generate a Raman pump. An IBC laser is a laser that generates beams from an array of multiple gain elements or emitters (elements 15-1 through 15-N of FIGURE 4). The beams are incoherently combined or multiplexed by a diffraction grating (element 43 of FIGURE 4). After multiplexing, feedback is generated by a suitable partial reflector. The feedback is then demultiplexed by the diffraction grating for provision to the gain elements or emitters. Because the feedback is directed by the diffraction grating, the spectral characteristics of the feedback provided to each emitter is dependent upon the position of the emitter on the array. *See* paragraphs **[0040]-[0042]** of the application.

In one embodiment, multiple groups of emitters are provided (see 62-1 through 62-N and 63-1 through 63-N of FIGURE 6) on an emitter array. Each group of emitters is coupled to a single electrode and each emitter within the respective group operates at substantially the same power. *See* paragraph **[0050]** of the application. Coupling emitters in groups reduces the complexity of manufacturing the emitter array, because wire bonding of a discrete wire to each emitter is not required. The adaptation of the emitter array in this manner provides

another advantage. Specifically, each emitter of each group can be driven in a region of optimal electrical efficiency (i.e., significantly above the threshold current of the emitters). *See* paragraph **[0050]** of the application.

One representative embodiment achieves flat Raman gain even when groups of emitters are operable at the same power level by varying the emitter characteristics. Namely, the spacing between emitters varies between the portion of the array generating longer wavelengths (the "red" side) and the portion of the array generating shorter wavelengths (the "blue" side). Additional power is thereby allocated to the blue end of the array. The additional power present in the generated Raman pump at the shorter wavelengths addresses Raman self-amplification and thereby enables flat Raman gain. *See* paragraph **[0048]** of the application.

The spectral profile of a Raman pump generated by implementing an emitter array in this manner is shown in FIGURE 5A. In contrast, reference is made to FIGURE 2C which depicts the spectral profile of a Raman pump generated by an IBC laser having equally spaced emitters. As seen in FIGURE 2C, multiple emitters are operated at relatively low powers. Accordingly, the electrical efficiency of operating those emitters is reduced.

VI. ISSUE

The issue involved in this appeal is whether claims 37-56 are patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 6,192,062 to Sanchez-Rubio et al. (hereinafter the Sanchez-Rubio reference) in view of the article "Pump Interactions in 100-nm Bandwidth Raman Amplifier," by Kidorf, IEEE Photonics Technology Letters, Vol. 11, No. 5, May 1999 (hereinafter the Kidorf article), in further view of U.S. Patent No. 6,418,152 to Davis et al. (hereinafter the Davis reference).

VII. GROUPING OF CLAIMS

For purposes of this appeal brief only and without conceding the teachings of any prior art reference, the claims have been grouped as follows:

Claims 37, 38, 40-48, 50-56 (Group I); and
Claims 39 and 49 (Group II).

The claims do not stand or fall as a group. Additionally, Appellant has included arguments supporting the separate patentability of each claim group in Section VIII pursuant to MPEP § 1206.

VIII. ARGUMENTS

Claims 37-56 are rejected as being unpatentable under 35 U.S.C. § 103(a) over the Sanchez-Rubio reference in view of the Kidorf article in further view of the Davis reference.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art cited must teach or suggest all the claim limitations. *See* M.P.E.P. § 2143. Appellant respectfully submits that the rejection does not satisfy these criteria.

Claims 37 and 47

Claim 37 recites:

> driving a plurality of gain elements according to groups of multiple gain elements, such that a respective drive signal is provided to each group to cause each gain element of the respective group to operate at substantially the same power within a region of optimal electrical efficiency;
> diffracting beams from said plurality of gain elements toward a partially reflective element using a diffractive element;
> generating feedback for said plurality of gain elements using said partially reflective component;
> directing respective spectral components of said feedback using said diffractive element toward respective gain elements of said plurality of gain elements; and
> providing optical power transmitted by said partially reflective component to a Raman amplifier to generate substantially flat Raman gain across at least one telecommunications band.

Claim 47 recites:

> a plurality of groups of multiple gain elements, wherein a respective drive signal is provided to each group to cause each gain element of the respective group to operate at substantially the same power within a region of optimal electrical efficiency;
> a diffractive element diffracting beams from said plurality of groups of multiple gain elements toward a partially reflective component;

said partially reflected component generating feedback directed toward said diffractive element;

said diffractive element directing spectral components of said feedback toward respective gain elements of said plurality of groups of multiple gain elements; and

a Raman amplifier receiving optical power transmitted by said partially reflective component that generates substantially flat Raman gain across at least one telecommunication band.

The Sanchez-Rubio reference merely discloses an ordinary IBC laser that employs a diffraction grating to multiplex beams from multiple emitters and to direct spectrally unique feedback to the emitters. *See* FIGURE 1, col. 5, lines 10-24 and col. 6, lines 9-21 of the Sanchez-Rubio reference. The Sanchez-Rubio reference does not disclose a particular application for its IBC laser and does not teach or suggest using the IBC laser to generate a Raman pump. Moreover, the Sanchez-Rubio reference does not disclose any particular manner for driving the emitters of its emitter array. The Examiner acknowledges the lack of teaching and suggestion in the Sanchez-Rubio reference. *See* Office Action, dated November 21, 2003, page 3.

The Examiner relies upon the Kidorf article to assert that it would have been obvious to use the IBC laser shown in the Sanchez-Rubio reference to generate a Raman pump. Office Action, page 3. Appellant notes that the Kidorf article does not teach or suggest multiple groups of emitters where each emitter in a respective group is operated at the same power level as demonstrated by FIGURE 3 of the Kidorf article.

The Examiner relies upon the Davis reference to provide a teaching regarding driving groups of emitters. The Examiner asserts that the Davis reference discloses that the drive current sent to each group of emitters may be identical or varied. Office Action, page 3.

However, the Davis reference does not disclose driving multiple groups of emitters using respective drive currents. Instead, in one embodiment, the Davis reference explicitly teaches that "the amplitudes of the drive currents applied to the individual laser amplifiers are varied to achieve so as to have a Gaussian envelope." Col. 4, lines 28-31. Thus, in this particular embodiment, a separate drive signal is provided to each emitter. In a different embodiment, the Davis reference discloses that all emitters can be driven by the same output power. Col. 4, lines 34-40. In the second embodiment, there is only one group of amplifiers.

Additionally, the purpose of using the Gaussian envelope is to obtain a temporal profile as shown in FIGURE 5A of the Davis reference. The Examiner has stated that it would have been obvious to combine the Davis method of driving amplifiers with the teachings of the Sanchez-Rubio reference and the Kidorf article to obtain such a temporal profile. However, the stated motivation is insufficient. There is no articulated reasoning in the applied references or the Office Action to explain how the temporal profile would have any effect on the generation of Raman gain. Because there is no reason to conclude that the combination would have any effect (yet alone a beneficial effect) on the generation of Raman gain, the motivation to combine has not been established.

Accordingly, Appellant respectfully submits that the applied references (either alone or in combination) do not teach or suggest (i) driving a plurality of gain elements according to groups of multiple gain elements, such that a respective drive signal is provided to each group to cause each gain element of the respective group to operate at substantially the same power within a region of optimal electrical efficiency; or (ii) a plurality of groups of multiple gain elements, wherein a respective drive signal is provided to each group to cause each gain element of the respective group to operate at substantially the same power within a region of optimal electrical efficiency, in the context of generating Raman gain using an IBC laser in the manner recited by claims 37 and 47. *See In re Royka*, 180 USPQ 580 (CCPA 1974); *In re Wilson*, 165 USPQ 494, 496 (CCPA 1970). Moreover, the requisite motivation to combine or modify the references has not been established. *See In re Linter*, 173 USPQ 560, 562 (CCPA 1972).

Appellant respectfully submits that claims 37 and 47 are patentable over the applied references under 35 U.S.C. § 103(a). Claims 38-46 and 48-56 respectively depend from independent claims 37 and 47 and are likewise patentable.

Claims 39 and 49

Claim 38 recites "wherein said plurality of gain elements are integrated on a single integrated semiconductor element." Claim 39 depends from claim 38 and further recites "wherein spacings between gain elements generating optical power of shorter wavelengths are smaller than spacings between gain elements generating optical power of longer wavelengths."

Claim 48 recites "wherein said plurality of groups of multiple gain elements are integrated on a single integrated semiconductor element." Claim 49 depends from claim 38 and further recites "wherein spacings between gain elements generating optical power of shorter wavelengths are smaller than spacings between gain elements generating optical power of longer wavelengths."

The Examiner's articulation of reasons for the rejection of claims 39 and 49 is not completely understood. Appellant interprets the rejection of these claims to mean that while the applied references do not teach or suggest spacing the emitters as claimed, such spacing would have been made by one skilled in the art by matter of engineering choice. *See* Office Action, page 3.

Appellant submits that the claimed spacing relationships on an integrated semiconductor element are not a matter of mere engineering choice. Specifically, the integrated semiconductor emitter spacings ensure that a defined spectral density is achieved when the lasing wavelengths are constrained by the feedback scheme of an IBC laser. *See* paragraph **[0048]** of the application. Accordingly, additional power may be allocated to the shorter wavelengths (the blue side of the spectrum) and reasonably flat Raman gain may be achieved using an IBC laser containing the appropriately adapted semiconductor element. Accordingly, the claimed spacing relationship modifies the operation of an IBC laser used to generate a Raman pump in a manner that is novel and nonobvious. Therefore, claims 39 and 49 cannot be properly rejected without a specific showing that the limitations are taught or suggested by the applied art. *See In re Royka*, 180 USPQ 580 (CCPA 1974).

Additionally, the Examiner has stated that it would have been obvious to make the modification, because such spacing would "help eliminate cross talk between the gain elements." Office Action, page 3. Appellant notes that the proffered motivation is misplaced, because the IBC laser of Sanchez-Rubio already possesses a mechanism to reduce cross talk. Specifically, Sanchez-Rubio discloses that "spatial filter 34 is positioned between the grating 24 and the partial mirror 40" and "this eliminates cross talk between the gain elements 14." Col. 5, lines 32-33 and lines 42-43. Thus, one of ordinary skill in the art would not be motivated by the reason proffered by the Examiner.

Thus, the applied references fail to teach or suggest each and every limitation of claims 39 and 49. Also, the requisite motivation to combine or modify has not been established. Appellants respectfully submit that the rejection of claims 39 and 49 is improper.

Claims 39 and 49 (Group II) are also separately patentable, because these claims recite limitations related to spacings associated with a semiconductor element that (i) are not recited by the claims of Group I and (ii) are not taught or suggested by the applied references.

IX. CLAIMS INVOLVED IN THE APPEAL

A copy of the claims involved in the present appeal is attached hereto as Appendix A. As indicated above, the claims in Appendix A are the claims presented in the amendment, dated September 29, 2003.

Appellant believes no fee (other than the appeal brief fee addressed in the transmittal) is due with this response. However, if any other fee or fee amount is due, please charge our Deposit Account No. 06-2380, under Order No. 60988/P001US/10103485 from which the undersigned is authorized to draw.

Dated: July 19, 2004

Respectfully submitted,

By Christopher S.L. Crawford

Christopher S. L. Crawford
Registration No.: 51,586
FULBRIGHT & JAWORSKI L.L.P.
2200 Ross Avenue, Suite 2800
Dallas, Texas 75201-2784
(214) 855-8000
(214) 855-8200 (Fax)

APPENDIX A

Claims 1-36 (Cancelled)

37. A method, comprising:

driving a plurality of gain elements according to groups of multiple gain elements, such that a respective drive signal is provided to each group to cause each gain element of the respective group to operate at substantially the same power within a region of optimal electrical efficiency;

diffracting beams from said plurality of gain elements toward a partially reflective element using a diffractive element;

generating feedback for said plurality of gain elements using said partially reflective component;

directing respective spectral components of said feedback using said diffractive element toward respective gain elements of said plurality of gain elements; and

providing optical power transmitted by said partially reflective component to a Raman amplifier to generate substantially flat Raman gain across at least one telecommunications band.

38. The method of claim 37 wherein said plurality of gain elements are integrated on a single integrated semiconductor element.

39. The method of claim 38 wherein spacings between gain elements generating optical power of shorter wavelengths are smaller than spacings between gain elements generating optical power of longer wavelengths.

40. The method of claim 37 wherein said telecommunications band includes wavelengths from 1530 nm to 1565 nm.

41. The method of claim 37 wherein said telecommunications band includes wavelengths from 1480 nm to 1525 nm.

42. The method of claim 37 wherein said telecommunications band includes wavelengths from 1570 nm to 1610 nm.

43. The method of claim 37 wherein a first group of multiple gain elements is integrated on a first single semiconductor element and a second group of multiple gain elements is integrated on a second single semiconductor element.

44. The method of claim 43 wherein said diffractive element comprises a first diffraction grating and a second diffraction grating.

45. The method of claim 44 further comprising:

combining beams from said first and second diffraction gratings using a dichoric beam combiner before generating said feedback.

46. The method of claim 37 further comprising:

multiplexing an output from a narrowband laser with optical power transmitted by said partially reflective component, wherein said narrowband laser generates an output beam of a lower wavelength than wavelengths generated by said plurality of gain elements.

47. A system, comprising:

a plurality of groups of multiple gain elements, wherein a respective drive signal is provided to each group to cause each gain element of the respective group to operate at substantially the same power within a region of optimal electrical efficiency;

a diffractive element diffracting beams from said plurality of groups of multiple gain elements toward a partially reflective component;

said partially reflected component generating feedback directed toward said diffractive element;

said diffractive element directing spectral components of said feedback toward respective gain elements of said plurality of groups of multiple gain elements; and

a Raman amplifier receiving optical power transmitted by said partially reflective component that generates substantially flat Raman gain across at least one telecommunication band.

48. The system of claim 47 wherein said plurality of groups of multiple gain elements are integrated on a single integrated semiconductor element.

49. The system of claim 47 wherein spacings between gain elements generating optical power of shorter wavelengths are smaller than spacings between gain elements generating optical power of longer wavelengths.

50. The system of claim 47 wherein said telecommunications band includes wavelengths from 1530 nm to 1565 nm.

51. The system of claim 47 wherein said telecommunications band includes wavelengths from 1480 nm to 1525 nm.

52. The system of claim 47 wherein said telecommunications band includes wavelengths from 1570 nm to 1610 nm.

53. The system of claim 47 wherein a first group of said plurality of groups is integrated on a first single semiconductor element and a second group of said plurality of groups is integrated on a second single semiconductor element.

54. The system of claim 53 wherein said diffractive element comprises a first diffraction grating and a second diffraction grating.

55. The system of claim 54 further comprising:

a dichoric beam combiner for combining beams from said first and second diffraction gratings before reflection by said partially reflective component occurs.

56. The system of claim 47 further comprising:

a narrowband laser for generating an output beam of a lower wavelength than wavelengths generated by said plurality of groups; and

a multiplexer for multiplexing said narrowband laser with optical power transmitted by said partially reflective component.